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REMARKS

Examination is respectfully requested in view of the following remarks.

Disposition of Claims

Claims 1-4 and 6-21 remain pending in the instant application. Specifically, claims 1-4 and 11 have been withdrawn from consideration in view of the Examiner's restriction requirement, while claims 12-21 have been either rejected or objected to in view of prior art cited by the Examiner. Finally, claims 6-10 have been allowed, while claim 5 has been previously cancelled without prejudice or disclaimer.

Drawings

The Applicant gratefully acknowledges the Examiner's acceptance of the formal drawings filed on August 11, 2005.

Summary of Prior Art Rejections

The Examiner has rejected claims 12-14 and 17-20 under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 4,263,586 to John ("John") in view of U.S. Patent No. 5,546,009 to Raphael ("Raphael") and U.S. Patent No. 6,688,329 to Murray et al. ("Murray"). In addition, the Examiner has rejected claim 21 under 35 U.S.C. 103(a) as being unpatentable over Pankow ("Pankow").

Claimed Invention As Presently Amended Is Patentable Over John In View Of Raphael and Murray

As noted above, the Examiner has rejected claims 12-14 and 17-20 as being unpatentable over John in view of Raphael and Murray.

The Examiner asserts that the John reference discloses a method of introducing a signal into a fluid receiving space such that the signal is present for sensing within the fluid at a predetermined level. In addition, it is contended that John further discloses,

inter alia, that the signal is transmitted through the fluid receiving space according to a value of electric conductivity of the fluid and that a probe is provided at the predetermined level for sensing the signal; sensing for the presence of the signal within the fluid at the predetermined level; and providing a control function in response to whether the signal is so sensed in order to indicate whether the fluid is or is not present while also establishing a delay on make and/or delay on break time for indicating that the fluid is lower that the predetermined level. However, the Examiner admits that the reference does not teach using a microprocessor to control the functions of the apparatus nor does the reference disclose selectively adjusting the sensitivity of the probe.

The Examiner contends that the Raphael reference discloses a method of sensing the presence or absence of a fluid at a predetermined level by detecting with a probe a signal transmitted through the fluid based on the electrical conductivity of the fluid, selectively adjusting the sensitivity of the probe-responsive circuitry of the fluid, and selectively adjusting the sensitivity of the probe-responsive circuitry according to the value of the fluid conductivity. According to the Examiner, it would have been obvious to one of ordinary skill in the art to combine the teachings of Raphael with the method of John because adjusting the sensitivity allows the apparatus to be used with a larger and more diverse array of fluids while maintaining accurate measurements.

Finally, the Examiner asserts that the Murray reference discloses a method for determining whether a fluid is at a predetermined level in a fluid-receiving space in which a microprocessor is used to control sensing and also control function including delay on make or delay on break operations. The Examiner concludes that it would have been obvious to combine the teachings of Murray with the method of John because it is well known that microprocessors allow for more accurate and efficient operation of measurement processes.

In response, the Applicant has amended independent claim 12 in order to overcome the prior art cited by the Examiner. Specifically, claim 12 has been amended

to remove the alternative language related to control function determining either a delay on make or delay on break operations for indication that fluid is lower than the predetermined level. In particular, claim 12 as presently amended recites that the control function uses the microprocessor control to determine a delay on make, or both a delay on break and delay on make operations. Accordingly, none of the cited prior art references, either alone or collectively, teach or suggest a control function capable of determining a delay on make let alone a delay on make and delay on break operations as presently recited by claim 12.

A review of the John reference discloses a system for monitoring the liquid level in containers such as boilers and tanks. The reference further discloses a probe powered by electrical AC current that is positioned at a low liquid level such that a probe energizing path may be traced to the liquid in the container which is sensed by the probe and provides an indication that there is liquid in the container. In addition, a delay circuit is provided in order to prevent nuisance shutdowns caused by oscillating water contact between the ground and the probe. In particular, John discloses that a 30 second retard system was developed to hold the operating relay in for that period while continuing to recheck the water level through the time cycle. The retard system disclosed in the reference shuts down after the expiration of the period should the water level remain below the level of contact with the probe. See Col. 1, lines 62-68. Although the delay circuit holds the operating relay in over a predetermined delay period in order to recheck the water level and ensure that water is not contacting the probe, the John reference fails to teach or suggest a delay on make operation, nor both delay on break in combination with a delay on make operation as presently recited by claim 12.

A review of the Raphael reference discloses a fluid detection system capable of detecting the smallest amount of liquid by detecting conductance when the liquid is subjected to very small amounts of electrical power in a small sampling area. The fluid detection system includes an electronic control module and a sensing probe wherein the control module provides limited and controlled amounts of voltage and current to one or more remotely located probes. The voltage developed across the electrodes is

entered into a comparator circuit and compared to a reference to produce a signal defining either a dry or a wet condition of the sensing probe. However, Raphael does not disclose any type of delay on make or delay on break operations.

Finally, a review of the Murray reference discloses a water feeder controller for a boiler that monitors a low water cut-off sensor in a boiler and uses a feed timer to feed water to the boiler for a predetermined period of time. The feed timer may be implemented by microprocessor and supplies water to the boiler only if the low water cutoff sensor continues to indicate a low water level for a delay period of time measured by a delay circuit. However, the Murray reference fails to teach or suggest a control function that determines either a delay on break and delay on make operations as presently recited by amended claim 12.

Although the John reference discloses a delay on break operation, the reference fails to teach or suggest a delay on make operation let alone a combination of delay on make and delay on break operations as presently recited in claim 12. As noted above, John only discloses that a 30 second retard system was developed to hold the operating relay in for that period while continuing to recheck the water level through the time cycle. The retard system disclosed in the John reference shuts down after the expiration of the period whenever the water level remains below the level of the contact with the probe. See Col. 1, lines 62-68. However, there is no teaching or suggestion in the John reference that a delay on make operation be implemented that delays the transmission of a signal indicating that water has contacted the probe until a predetermined period of time has expired.

In other words, the John reference only discloses a delay on break operation wherein the microprocessor permits a predetermined period of time to expire when fluid is not in contact with the probe in order to make a determination is made that fluid is actually present at the level of the probe. This delay on make operation is substantially different than a delay on break operation disclosed in the John reference since the determination for a delay on make operation is whether the fluid is contacting the probe

over a predetermined period of time rather than not in contact with the probe. Accordingly, the John reference does not teach or suggest a delay on make operation, nor a delay on make operation in combination with a delay on break operation as presently recited in independent claim 12.

Based on the foregoing, neither John, Raphael, nor Murray teach or suggest, either alone or in combination, a microprocessor control to determine a delay on make, or delay on make and a delay on break operations for indication that fluid is lower than a predetermined level as presently amended in independent claim 12. Accordingly, the Examiner is respectfully requested to withdraw his rejection of independent claim 12 and indicate the allowance thereof. In addition, the Examiner is respectfully requested to withdraw his rejection of dependent claims 13, 14 and 17-20 by virtue of their respective dependencies from independent claim 12 and indicate the allowance thereof.

Claimed Invention Is Patentable Over Pankow

As noted above, the Examiner has rejected claim 21 as being unpatentable over Pankow.

The Examiner asserts that Pankow teaches a method of probe monitoring of a liquid in a vessel, comprising: introducing the bipolar periodic signal (413) to the vessel for being picked up by the probe; using a probe signal-responsive control (460) operable in response to sensing of the signal by the probe; processing of the signal in a pair of separate signal paths (420, 430) for responding to different polarities of the bipolar signal; and signaling in response to proper operation of both of the signal paths, whereby signaling is a fail-safe operation.

The Examiner admits that Pankow fails to specifically teach signaling only when proper operation of both signal paths is present. However, the Examiner concludes that it would have been obvious to one of ordinary skill in the art to only signal when both paths are operating otherwise the method would not produce an accurate measurement, i.e. the apparatus requires signals from both paths to operate properly.

A review of the Pankow reference discloses circuitry that splits and processes a time varying excitation current into two monopolar signals that reference each other. These two monopolar signals are essentially mirror images of one another to generate a differential signal. Although the time varying excitation current is comprised of two parts, once recombined, the resultant signal output is the same as the signal prior to being split into two differential components.

A review of Pankow reference shows that the failure of any components in either network in the Pankow circuitry will nevertheless produce an output from the circuitry that is not detectable as invalid by the system. For example, if resistor R4 short circuits in FIG. 5 of Pankow, this would simply change the gain of amplifier 433 while still producing an output that would be mixed with the other monopolar signal in amplifier 460. Amplifier 460 would output a voltage at TP-3 that would fall in the range of a valid sensor reading by the capacitive sensor and therefore indicate proper operation of the Pankow circuitry even though a short circuit exists. As such, when such a failure occurs in the Pankow circuitry, the Examiners' contention that the Pankow circuitry meets the claim limitation that a signaling is made in response only to <u>proper</u> operation of both of the at least pair of signal paths is inaccurate since a signal will be generated regardless of the circuit failure. The Pankow circuitry generates an output that is not accurate when the resistor R4 has short circuited, thereby causing the Pankow circuitry to <u>not</u> operate properly despite the fact that a signal is produced along both signal paths. Accordingly, Pankow does not teach nor suggest the limitation of signaling in response only to proper operation of both of the at least a pair of signal paths.

In further contrast, the claimed invention utilizes two separate signal paths that are not differential as in Pankow, but rather processes a bipolar, periodic signal to achieve a redundant, fail-safe operation. The diodes D2 and D4 in FIG. 4 bypass resistors R3 and R2, respectively, which requires a voltage signal from the probe that is bipolar in nature. During the negative half cycle of the probe signal, network 122A has its diode D2 forward biased which creates a voltage divider with resistors R16 and R3 in

network 122B. The corresponding voltage from the voltage divider then charges capacitor C3 to a voltage representative of the probe signal strength. During this negative half cycle, the network 122A receives no signal from the probe whereas network 122B receives the entire signal.

Conversely, during the positive half cycle of the probe signal, network 122B has diode D4 forward biased which creates a voltage divider with resistors R1 and R2 in network 122A. The corresponding voltage from this voltage divider then charges capacitor C2 to a voltage representative of the probe signal strength. During this positive half cycle, the network 122B receives no signal from the probe whereas network 122A now receives the entire signal. As such, the two signal paths, network 122A and network, 122B are not differential, as required by the Pankow circuitry, but operate in different opposite polarities of a bipolar signal as recited in independent claim 21 in order to provide redundancy in the circuit and a fail safe operation. On the other hand, Pankow utilizes two signal paths to generate a differential signal in order to compensate for the added capacitance due to cabling attached to the capacitive sensor. By processing a single signal, differentially, the capacitive sensor signals can be monitored more accurately and reliably than capacitive sensors monitored by a signal-end unipolar method.

As such, the Pankow reference does not teach nor suggest processing of the sensed signal, for purposes of signaling, in at least a pair of separate signal paths for responding to respective <u>different</u> polarities of the bipolar signal sensed by the probe, nor does the reference teach or suggest the limitation of signaling in response only to proper operation of both of the at least a pair of signal paths as presently claimed by the Applicants. Accordingly, the claimed method of independent claim 21 is patentable over the Pankow reference and the Examiner is respectfully requested to withdraw his rejection and indicate the allowance thereof.

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CONCLUSION

By the present amendment and response, the Applicant has amended the claims and provided arguments in support of his position that the claimed invention directed to a method of electronically determining whether fluid is at a predetermined level by a microprocessor control in order to determine a delay on make and a delay on break operations is patentable over the prior art. Based on the foregoing, the application is believed to be in a condition for allowance and expeditious notice thereof is earnestly solicited.

The Examiner is requested to call the undersigned attorney collect if he has any questions related to the Applicant's remarks.

9/1/2006
Date

Respectfully submitted,

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